

HABITAT MANAGEMENT GUIDELINES FOR OSPREYS AND GREAT BLUE HERONS  
BREEDING AT OLD SANTEE CANAL STATE PARK

Prepared by  
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for

The South Carolina  
Department of Parks, Recreation & Tourism

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## INTRODUCTION

These guidelines were prepared in consultation with numerous published and unpublished sources, and, although they are advisory in nature, they represent a biological interpretation of the minimum standards that need to be employed to maintain existing breeding populations of Ospreys and Great Blue Herons at Old Santee Canal State Park. Throughout the document emphasis is placed on activities that need to be avoided or minimized near existing Osprey and heron nests, especially during the breeding season.

Although both Ospreys and Great Blue Herons are known to breed in close association with human activity, individuals of both species exhibit considerable variation in their response to human activity near nests. There are numerous reports in the literature that clearly demonstrate that encroaching human activity near formally isolated nests of both of these species can induce both immediate and delayed abandonment of nests and colony sites.

Responses of both species to human activity appear to depend in part upon the type, frequency, and duration of activity; extent to which the environment is modified by such activity; nesting phenology; and other unknown factors. Therefore it is difficult to predict with certainty the effects a disturbance might have in a particular breeding situation. Certain human activities, however, are known to disturb Ospreys and Great Blue Herons more than others; these activities are addressed below. The



guidelines provided are divided into sections on nesting, feeding, and roosting.

#### NESTING GUIDELINES

Although several Great Blue Herons currently nest at the Park, all of them do so at a single colony site. There is considerable evidence in the scientific literature, both for this species and others, that disturbance at a colony site often induces the abandonment of the entire colony, rather than only that of the individuals nearest the disturbance. As such abandonment is often long term, if not permanent, I strongly recommend that both the Osprey and Great Blue Heron nesting populations at the site be treated as currently existing at their minimal permissible levels. Therefore, my recommendations will be aimed at maintaining or improving those nesting populations.

#### General considerations for Ospreys

In South Carolina, the Osprey nesting period extends from mid-February through mid-August. Individual pairs return to the same territories year after year, and territories may even be inherited by subsequent generations. Ospreys are most vulnerable to immediate abandonment as a result of human disturbance occurring early in the nesting period, especially during courtship, but also during nest refurbishing, egg laying,



incubation, and early brooding (i.e., mid-February through late May). In addition to immediate abandonment of the nest, disturbance during this period can result in chilled or overheated eggs or young, and might result in subsequent "abandonment" at the end of the current nesting season. (Human activity near the nest later in the nesting cycle may cause premature fledging.) Although immediate abandonment of the current nesting attempt, along with subsequent relocation of future nesting attempts, is, unfortunately, often the first and only sign of human disturbance, Ospreys are quite vocal in and around their nests. Increases in this activity, especially if it is directed at encroaching humans, should be viewed as an early warning sign of human disturbance, and appropriate action (immediate cessation of the activity) should be taken immediately.

Although Osprey nests are an important attraction for nesting birds, the nest, in and of itself, is often inconsequential when compared with other features of the habitat. Currently, the single Osprey nest site at the Park is located in a snag. If that snag or nest should fall, as a consequence of a winter storm or fall hurricane, for example, I strongly recommend that several nesting platforms, together with a rudimentary nests, be placed near the former nest as soon as possible thereafter, but certainly before the Ospreys return in February. However, even if this occurs and the birds do not reestablish themselves at the site, and apparently abandon it for another (either within or



beyond the Park boundaries), management guidelines outlined above and below should continue to apply in the absence of nesting Ospreys for at least two complete breeding seasons after the loss. The same criterion should apply in the advent of a seeming "abandonment" of the current nest site without the concurrent loss of the nest itself.

Management zone for Ospreys

I recommend than a management zone of between 500 and 1,000 feet be established around the current Osprey nest site at the Park. I consider this to be a minimal permissible range, as a similar zone established recently by the U S. Fish and Wildlife Service for activity around Bald Eagle nests extends from 750 to 1,500 feet from each nest site. (The exact dimensions of the zone should be determined on the basis of landscape features at the site.) Construction should be limited to areas near the perimeter of this zone, and should consist only of modest trails, boardwalks, and enclosed blinds for viewing wildlife. Construction of these structures should occur only during the non-breeding season, preferably from October through January, and in no instance when Ospreys are present at the site. When Ospreys first arrive at the site in late winter activity by park visitors and maintenance personnel should be prohibited in the management zone, as should the operation of helicopters and



fixed-winged aircraft flying at less than 500 feet over the nest. (Because it may be difficult for Park personnel to determine exactly when Ospreys do arrive, I recommend that this restriction apply from 1 February until the chicks can be seen standing in the nest exercising their wing [i.e., at about 6 weeks of age].) Only after naturalists at the Park have determined that the chicks are about to fledge should visitors be permitted within the management area, and even then there activities should be limited to established trails.

Continual monitoring of Osprey breeding activity by appropriate Park personnel will be needed to assess the adequacy of this management plan.

#### General considerations for Great Blue Herons

Great Blue Herons begin nesting activities in South Carolina in February. However, because many Great Blue Herons are year-round residents in the state, it may be difficult for Park personnel to document when nesting activity begins. For this reason, and because disturbance at colony sites is likely to be especially disruptive early in the nesting season, I strongly recommend that activity near the colony site be prohibited from late January through late May. Although Great Blue Herons, along with Ospreys, are often seen in close association with human activity, for Great Blue Herons, at least, individuals in close association with human activity are almost always feeding, not



nesting, birds. Indeed, breeding wading birds, including Great Blue Herons, are well known for their wariness. For example, a recent study of colony sites including this species along the Mississippi River revealed that only one of 27 sites was closer than 300 m to a human habitation. Some researchers have even suggested that recent declines in populations of this species in several midwestern states has resulted primarily from human disturbance at nest sites.

#### Management zone for Great Blue Herons

Studies at Great Blue Heron colony sites in other portions of their range indicate that although birds are disturbed at greater distances early in the breeding cycle, individuals continue to be disturbed at distances as great as 300 feet throughout the nesting period. Therefore, I strongly recommend that a management zone for the Great Blue Heron colony at the Park extend at least 500 ft from the colony site. Because Great Blue Herons traditionally nest only in relatively large mature trees, and because such trees are often a limiting factor in determining the location of a colony site, I strongly recommend that no trees, living or dead, be removed within the zone at any time of year. The same restrictions concerning construction, air traffic, and human activity mentioned above for the Osprey management zone should apply within the management zone for Great Blue Herons. Again, activity within the management zone would be



especially disruptive early in the breeding cycle. Overall, visitor activity and Park maintenance should be prohibited in this zone from late February through the time that chicks are about to fledge in late May-early June.

Continual monitoring of Great Blue Heron breeding activity by appropriate Park personnel will be needed to assess the adequacy of this management plan.

#### FEEDING GUIDELINES

Protection of nesting sites is an essential feature of any habitat management plan for Ospreys and Great Blue Herons. However, protecting the "bedrooms" (i.e., nest sites) of these two species alone will be of little value if important "kitchens" (i.e., feeding sites) within the Park are not also protected. The guidelines below are intended to maintain or enhance the quality of feeding sites for Ospreys and Great Blue Herons at the Park.

Implementation of these recommendations will require continual monitoring of feeding Ospreys and Great Blue Herons at the Park by Park personnel.

#### Recommendations:

- A. The use of toxic chemicals within the Park's watershed should be prohibited.



B. Shorelines within the Park, especially those that border shallow areas likely to be used by feeding Great Blue Herons, should not be altered.

C. Dredging should be prohibited in shallow areas likely to be used by feeding herons.

D. Water quality in areas within the Park used by feeding Ospreys and Great Blue Herons should be monitored and remedial steps taken when needed.

#### ROOSTING GUIDELINES

Great Blue Herons sometimes roost communally during the non-breeding season, often at breeding colony sites. Disturbance of birds at these sites may result in the subsequent abandonment of the breeding colony site in the Park if a sufficient number of the roosting birds are also breeding in the Park. The guidelines below are designed to help preserve present roosting sites and provide future habitat. Implementation of these recommendations will require monitoring of roosting herons by Park personnel.

#### Recommendations:

A. Within the management zone, no trees, living or dead, should be removed.



B. There should be no logging, land clearing, or disruptive human activity within 500 feet of traditional roosting sites located outside of the management zone for breeding Great Blue Herons.

#### LEGAL CONSIDERATIONS

It may be appropriate to inform Park visitors that both Great Blue Herons, and Ospreys, along with all other migratory birds in the Park are protected by Federal and State laws. For example, the Migratory Bird Treaty Act (16 U. S. C. 703-711) makes it unlawful "... to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess,...offer for sale, sell...,any migratory bird, any part, nest or eggs of any such bird...." Violators may be fined from \$500 to \$2,000 and imprisoned from 6 months to 2 years.



## INTERPRETIVE INFORMATION ABOUT OSPREYS

### INTRODUCTION

Ospreys are large, long-winged, eagle-like predatory birds that feed almost exclusively on live fish and are usually found near water. The species is one of the most cosmopolitan of all raptorial (i. e., predatory) birds, breeding not only in North and Central America, but in Europe, Asia, Africa, and Australia as well. In South Carolina, most Ospreys nest in the lower coastal plain, usually within several miles of the Atlantic Ocean, although the species is also found breeding along inland rivers and lakes.

Because they are a terminal link in the aquatic food chain, Osprey populations in North America declined dramatically earlier in this century during periods of widespread use of the pesticide DDT. DDT disrupted Osprey calcium metabolism and caused Ospreys to lay eggs with shells that were so thin they were crushed by the weight of incubating females. More recently, Osprey populations have been increasing nationally. The recent increases in reproductive success appear to be linked directly to decreases in pesticide residues in Ospreys, brought about, in large part, by the banning of DDT use in this country in 1972. Unfortunately, Ospreys often encounter DDT and other organochlorine pesticides no longer used in this country in countries they migrate to during the non-breeding season. Currently, the greatest threat to the Osprey in the U. S. appears



to be the destruction of its nesting and feeding habitats.

#### WHAT'S IN A NAME?

Earlier in this century, most North Americans called Ospreys "Fish Hawks." More recently, however, we have taken to following the European tradition of calling members of this species "Ospreys," an English name that comes from the Latin word ossifragus, meaning bone breaker. The scientific name for the species, Pandion haliaetus, is Greek. Pandion was the name of a mythical Athenian king whose two daughters were turned into birds by the gods. Haliaetus comes from two Greek words: hals (the sea) and aetos (the eagle).

#### OSPREYS ON MIGRATION

In the southeastern U. S. most newly fledged Ospreys remain within 100 miles of their nests at least until late August - early September. Most of these first-year birds, along with adult Ospreys, reach the Caribbean or South America, after migrating on a broad front, by mid October. For example, Ospreys migrating from North America, travel through Cuba in September, remaining on the island for only a short time, before continuing south to the South American mainland. In especially mild winters some Ospreys may be seen in warmer regions within the state throughout the winter.

Ospreys usually overwinter in northwestern South America and Panama. In spring most breeding-age birds (two years old and



older) have left South America for breeding sites in the North by late February. Most Ospreys breeding in South Carolina arrive by mid to late February. First year birds do not return to their eventual breeding sites during their first spring, but rather remain in South and Central America. They do, however, return to North American breeding grounds the following Spring. About one quarter to one half of these return to the state of their birth, and although they often court, build nests, and mate at this time, they rarely lay eggs during their first spring back.

#### DISTRIBUTION IN NORTH AMERICA

Although they are most common as a breeding species in coastal areas, Ospreys migrate throughout the continental U. S. The species breeds throughout the boreal region of Canada, often in association with beaver ponds. Indeed, the return of the beaver to portions of its range that were unoccupied recently have led to the establishment of breeding populations of Ospreys in those areas as well. In the Eastern U. S. Ospreys breed throughout peninsula Florida, along the Gulf and Atlantic coasts through New England and into Canada, as well as in the Great Lakes region. They are less common as a breeding species in the Mississippi drainage, although attempts at introducing them to this area appear to be meeting with success. Ospreys are more common as a breeding species inland in western states, especially in the Pacific Northwest, Idaho, Montana, Utah, Nevada, and even Alaska. Estimates from the early 1980s indicate that about 8,000



pairs breed in the conterminous U. S.

In the mid 1970s Ospreys were much less common along the South Carolina coast (111 pairs) than in coastal North Carolina (450 pairs). The majority of Ospreys nesting in South Carolina nest along the coast north of Charleston. The State's population of Ospreys seems to be doing quite well recently, with increased numbers of birds being sighted both in coastal areas and inland.

#### DISPERSAL

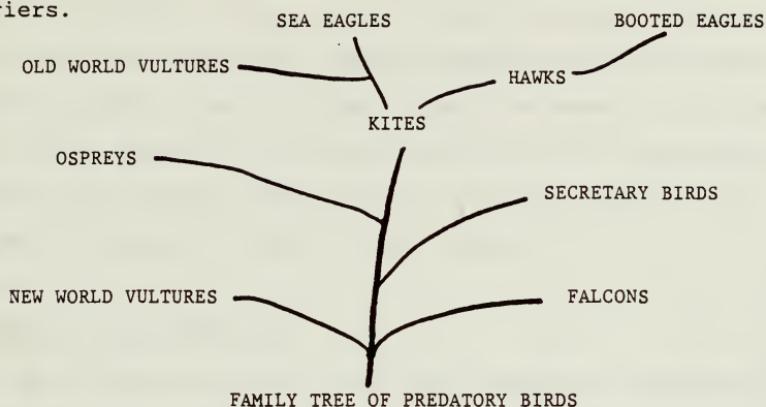
In North America, Ospreys appear to have the ability to pioneer new areas more than 100 miles from their birth place. For example, band recoveries reveal that although most Ospreys are recovered within 25 miles of their birth place, about a third are recovered more than 25 miles away during later breeding seasons. Researchers have suggested that reduced densities of Ospreys caused by the effects of DDT may have reduced the pressure to disperse in several affect populations.

#### OSPREYS AND EAGLES

The scientific names of the Osprey (Pandion haliaetus) and the Bald Eagle (Haliaeetus leucocephalus) are quite similar, but even though the two species resemble one another in general appearance, biologists have found enough differences between the two to place them on separate branches of the family tree of predatory birds. Ospreys are placed by themselves in the Family Pandionidae, while Bald Eagles are placed in the Family



Accipitridae, along with other eagles, kites, hawks, and harriers.



Ospreys, which weigh between 2.2 and 3.9 pounds, and have wing spans of six to six and a half feet, are slightly smaller and considerably lighter than are Bald Eagles, which weigh from 4.4 to 13.6 pounds and have wing spans of between seven and eight feet. Ospreys can be separated from eagles in the field by their smaller size, light-colored underparts (eagles are generally dark below), the decided "gull-like" crook in their wings (eagles fly with their wings flat), and the wide, dark eyeline that highlights their white head. Also, Ospreys usually hover when fishing; eagles rarely do so.

Although both species prey on fish, Ospreys feed almost exclusively on this source of food, while Bald Eagles are known to switch to waterfowl and carrion when fish are not readily available. When the two species breed in the same area, as they often do in South Carolina, the larger, and more powerful eagle



often pirates food from its Osprey neighbors by intercepting adults in flight as they return to their nests with food for their mates and offspring. Because Ospreys are outweighed by bullying eagles, they are almost always relieved of their booty. Many eagles appear to be piracy specialists and researchers believe that Ospreys often avoid nesting near eagles in an attempt to reduce the risk of prey robbery.

#### REVERSED SIZE DIMORPHISM

As is true of almost every other species of predatory bird, Ospreys exhibit what scientists refer to as reversed size dimorphism: females are considerably larger than males. For example, females usually weigh between 1,600 and 2,000 grams while males typically weigh 1,200 to 1,600 grams. The reason or reasons for this reversal of the typical male-larger-than-female dimorphism that occurs in birds is unknown. Scientists suggest that it may have something to do with parental care (females are larger so as to be better able to protect their offspring at the nest), or with hunting efficiency (males, which do most of the hunting during the breeding season, are smaller because by being so they require considerably less food for themselves and may be more maneuverable, and hence better hunters than females). However, considerable disagreement exists among scientists concerning the function of this unusual morphology.



## THE BREEDING SEASON

Ospreys breed for the first time when they are between three and five years old, presumably because it takes them that long to develop the fishing skills necessary to provide sufficient prey for their offspring. Males arrive at the breeding grounds several days before their mates. When the females do arrive, the males engage in courtship flights consisting of a spectacular series of alternating dives and climbs, which they often perform while carrying a fish in their talons. Throughout the ceremony males typically utter a high-pitched "pyeb-pyeb-pyeb," which they repeat at a rate of from 1.5 to 2.0 screeches/second. Males attempt to woo mates at this time by offering prospective females fish that they have caught, presumably as a display of their hunting prowess.

Osprey nests are normally placed at the top of dead or dying trees, although live trees, cliffs, the ground, and even man-made structures such as channel markers and utility poles are often used. Both sexes take part building the large stick nests that typify the species. Once a nest is built it is usually refurbished annually and used repeatedly, unless the pair is unduly disturbed. In South Carolina, typically 3 eggs are laid in late April and incubated for approximately 38 days by the female. During this period, the male provides food for his mate. He continues to do so until the nestlings fledge (leave the nest for the first time) after a period of from seven to eight weeks. Once the nestlings fledge, they remain in the vicinity of the



nest and are fed by their parents for several weeks before migrating.

#### PAIR BONDING

Ospreys typically mate for life (as long as both members of the pair survive to return to breed), although there are reports of divorce. Indeed one researcher reports mate switching in a population of Ospreys in New England. Nest-site fidelity is particularly high in Ospreys (the same nest is usually refurbished and reused annually), and some researchers have suggested that site fidelity, rather than mate fidelity is, in fact, responsible for lengthy pair bonds.

Polygamy, one male mating with two or even three females, has recently been reported in Ospreys. In one New England population, for example, 10 of 18 nestings were polygamist. Polygamy seems to be especially common where nests can be located within several hundred yards of one another. This presumably makes it easier for the bigamist to keep his eyes on all of his mates. Females from the same harem are sometimes observed squabbling for fish caught by their returning mate. The impact of bigamy on nesting success has not been studied in this species, but in other raptors, the number of young fledging from such nests tends to be lower than that fledging from monogamous nests.



### SIBLING AGGRESSION

Osprey chicks hatch asynchronously, and in some nests this may result in one chick being more than half a week older than its youngest sib. Aggression among chicks apparently depends on the amount of food available to the developing young. Although there are no reports of older young actually killing their younger sibs at times of food scarcity (as has been reported for several other raptors, including eagles), in some instances the smallest young may starve if enough food is not provided at the nest, as parents feed the most belligerent nestling, which is often the oldest in food-stressed nests. As with other raptors, sibling aggression during periods of food shortage appears to be an adaptation to ensure successful rearing of at least some young.

### LONGEVITY

The oldest Osprey record for a banded wild bird in North America is 21 years, 11 months (a retrapped bird that was later released). Most estimates of annual mortality indicate that 40-60% of recently fledged young die within their first year, but that after that, mortality quickly drops to less than 20% per year.

### UNWARINESS

The adaptability of Ospreys as a species toward man is apparent from their successful nesting under many circumstances,



including, channel markers in the Chesapeake Bay near constant boat traffic, and even in a parking lot of an amusement park. On the other hand, human activity near nests in more remote areas is known to lower nesting success significantly. Thus it appears that Ospreys, like many other animals including humans, vary considerably in their tolerance of people.

#### FEEDING OSPREYS

Because they feed in open areas when they can be observed easily by researchers, Osprey feeding behavior has been well studied. Unlike Bald Eagles, which glide at shallow angles toward the water's surface to snatch their prey, Ospreys usually dive at fish after hovering. Typically, an individual Osprey flies to a feeding area where it beats its wings rapidly and hovers in a stationary position for several seconds before either moving to another vantage point or plunging almost vertically 20-30 meters to crash feet-first through the water's surface after a fish. Although seasoned adult Ospreys usually catch a fish 4 out of 5 times that they break the water's surface, recently fledged juveniles may dive 10 or 15 times without catching prey. Especially skillful adults are reported to have caught two fish on a single dive! While most of the fish Ospreys catch weigh less than half a pound, reports from Europe indicate that they can catch fish of up to 3 pounds.

After they snatch their prey, Ospreys fly from the surface, shaking their wings vigorously to remove excess water, and then



orient their prey aerodynamically head-first in their talons. The outer toes of Osprey are reversible, enabling them to grasp fish with two toes forward and two toes back with each foot. Sharp spicules on the lower surface of their toes further enhance their ability to carry their slippery prey. As a result, once an Osprey has grasped a fish, it rarely loses it.

#### VOICE

Osprey vocalizations are usually characterized as a series of plaintive, shrill, staccato whistles, gradually rising in pitch. The larger female has a deeper voice than the smaller male. Individuals call both on the wing and when perched. Nestlings often peep when begging for food, at least when they first hatch. However, by the time they are ready to fledge at about 7 weeks of age there voice is quite similar to that of adults.



## INTERPRETIVE INFORMATION ABOUT GREAT BLUE HERONS

### INTRODUCTION

The Great Blue Heron is North America's largest member of the Heron Family, which includes 63 species of herons, egrets and bitterns worldwide. Individual Great Blue Herons can weigh as much as 8 pounds, and stand four and one half feet tall. Great Blue Herons are permanent residents of South Carolina that typically nest in colonies of a few pairs to several hundred birds, although solitary nesting is not uncommon. The species breeds throughout the eastern and western seaboards of the US, as well as in scattered locations inland. Individual "Great Blues" are often seen standing motionless in several inches of water along the banks of fresh and salt water creeks waiting patiently for fish to swim within reach of their powerful bill. One of the most graceful of all herons in flight, Great Blues usually fly with slowly flapping wings, their necks tucked majestically below their chests.

Although they are not as brightly colored as some of our other wading birds -- basically, Great Blue Herons are large grey birds with white crowns, cheeks, and throats, and distinctive chestnut thigh feathers -- during a brief courtship period in early spring their normally yellow eyes redden and their legs become a brilliant pinkish-orange. A white race of the species, sometimes mistakenly referred to as the Great White Heron, is found in southern Florida.

In the 19th century, as well as in the early part of this



century, many adult Great Blue Herons, along with their more colorful relatives, were slaughtered by what were then called "plume hunters," individuals who made their living selling the feathers of birds to the manufacturers of mens' and womens' hats, often at prices in excess of \$30 an ounce. Only after spirited lobbying and education efforts by conservation groups such as the National Audubon Society was legislation passed to protect these species. As a result, most populations of herons and egrets are no longer in immediate danger, although the loss of wetland habitats poses a continued threat to the success of these birds.

#### WHAT'S IN A NAME?

Great Blue Herons belong to the almost unpronounceable avian order Ciconiiformes (Latin for stork-like), a group of birds that includes the herons, egrets, bitterns, storks, ibises, and spoonbills. Herons, egrets, and bitterns are structurally quite similar; indeed, egrets are actually white herons that are so named because of their extraordinarily graceful white plumes, called aigrettes, that develop during the breeding season. . Little Blue Herons (Egretta caerulea), which, in fact are a dark slate-blue, unlike their basically light blue-grey Great "Blue" Heron cousins, are a different species entirely. Although they are sometimes called "Blue Cranes" by folk naturalists, Great Blue Herons are not at all closely related to either of North America's 2 species of cranes (the Whooping Crane and the Sandhill Crane), even though they bear a superficial resemblance



to the latter. The scientific name for the species, Ardea herodias, is taken from the Latin (ardea) and Greek (herodios) words for heron.

#### MIGRATION

Great Blue herons appear to migrate mainly by day, but at least in the fall, they also sometimes travel by night (recent evidence from Florida suggests that they also often feed at night, especially when aided by moonlight). Fledglings receive no additional fish from their parents, and most disperse from their nesting colony as soon as they can fly. In many cases post-fledging dispersal is several hundred miles to the North, and often further inland. These exploratory travels may be important in determining an individual's future breeding site. Great Blue Herons are considered permanent residents in the state, although considerable movements occur during the non-breeding season, when some birds move into the state from the north, while others leave for more southerly latitudes. Migration through the state in fall and spring is usually concentrated along the coast.

#### DISTRIBUTION AND TAXONOMY

Great Blue Herons breed throughout southern Canada, except in the Rocky Mountains, as well as throughout the U. S., again, except in mountainous areas. At least 7 subspecies of Great Blue herons are recognized, including three that occur, at least



occasionally in South Carolina. Most South Carolina Great Blue Herons belong to the herodias subspecies, whose common name is "Great Blue Heron." The rarest subspecies is commonly called the Great White Heron. Although accidental in our state, this subspecies can be seen regularly in extreme south Florida, especially in the Keys. Great White Herons, as their name indicates, are pure white with a yellow beak. Often confused with the Great White Egret, Great White Herons differ from the former in having greenish yellow rather than jet black legs. Ward's Heron, a large-bodied subspecies of the Great Blue Heron, is resembles the more common subspecies in the state to such an extent that only experts can separate the two subspecies in the field. Ward's Herons are believed to be the common breeding "Great Blue Heron" in southern coastal areas of South Carolina, including Hilton Head Island.

#### HERONS AND COLONIAL NESTING

Great Blue Herons typically build their nests close to one another's, near the tops of large cypress and pine trees. The number of nests at a colony site varies considerably from year to year. Males, which are slightly larger than their mates, are the first to arrive at the breeding colonies in the Spring. Males usually initiate courtship by displaying to females from old nest sites. During this phase of the breeding cycle, which lasts for only a few weeks, courting individuals develop the exquisite nuptial plumes that made this species so valuable to plume



hunters. Nests, which are crude platforms of sticks built mainly by the female, often measure more than 3 feet across. In South Carolina nesting begins in mid to late March. The eggs, of which 3 to 7 are laid, are a pale blue. Incubation takes about 28 days. Although herons are typically single-brooded, many pairs will relay a second and even third clutch in a single season, if earlier nesting attempts are disrupted. Typically, these "replacement clutches" contain one less egg than the original clutch. Both parents tend the nests and young. Older nestlings are notoriously feisty when approached by observers, snapping at them with their stout and potentially dangerous bills and often disgorging their most recent meal in the direction of the intruder.

Nesting success varies considerably from year to year, location to location, and even among pairs in the same colony, usually as a function of prey availability. Most nestling loss is the result of starvation, although predators such as raccoons, eagles, and owls take their toll. When food is scarce siblings sometimes fight among themselves and have even been known to kill each other in their attempts to secure sufficient prey from their parents. Even for the young that do leave the nest, the chances are 2 in 3 that they will not survive their first year. Survivorship increases substantially after that, however.

Why Great Blue Herons, along with many other wading birds place their nests in colonies close together, rather than separated from one another in individual territories, has long



puzzled scientists. Some researchers believe that by nesting together, birds that are having a difficult time locating sources of food can follow more fortunate birds from the colony to their feeding grounds. Others feel that nesting in colonies may afford pairs some protection from predators, in that many adults are available to defend the colony from intruders. Still others believe that appropriate nesting sites for the species are so scarce that all of the birds in the area are forced to use the few that are available. What ever the reason or reasons for colonial nesting, the behavioral pattern results in a sensational display of birdlife for several months each year.

#### REPRODUCTION

Most researchers believe that Great Blue Herons begin breeding when they are two years old, although little data exist to support that notion. Both sexes appear to arrive on the breeding grounds at about the same time, although males often precede females by several days. Herons engage in considerable courtship dancing before pairs are bonded each spring. The male apparently selects the breeding territory, which usually includes an old nest. Although Great Blue Herons often maintain feeding territories as well as territories around their nests, during the breeding season many individuals often feed in communal feeding areas without overt aggression. Sometimes larger hawks and owls nest in heron colonies along with the herons, and in Pennsylvania one heronry also served as the location of a Turkey Vulture



roost.

Herons are notoriously alert to the presence of people, especially when they first arrive at their breeding sites in the Spring. Seasonal monogamy is probably the rule in nesting pairs (i.e., individuals remain paired for only a single season).

#### LONGEVITY

Based on over 300 recoveries of banded birds, scientists estimate that approximately 70% of all fledgling Great Blue Herons die within their first year. In subsequent years mortality rates drop to about 30%. The longevity record for a wild banded bird is 23 years 3 months. The bird was banded and recovered in Ontario, Canada.

#### FEEDING BEHAVIOR

Although most species of wading birds feed in groups, Great Blue Herons typically are solitary feeders that defend their feeding sites against intruders. Herons usually feed by day, but in coastal areas where tides affect the availability of prey, many individuals spend considerable amounts of time feeding at night. Indeed, the 18th century naturalist and father of American Ornithology, Alexander Wilson, once commented that Great Blue Herons were "fat at the full moon, and lean at its decrease...;" probably because they were able to fish by moonlight in the former periods. When fishing, Great Blue Herons



spend most of their time standing and waiting for fish to swim by. Their long legs allow them to wade into relatively deep water to search for prey.

Although most of their diet consists of both large and small fish, western individuals have been reported hunting on dry land for small mammals, and throughout its range the species is known to consume nestling birds, small reptiles and amphibians, crabs, and shrimps. Small fish are usually swallowed whole, while herons often spear larger fish with their stout bills. Enormous fish are sometimes consumed, and individuals are known to have died after choking on fish that were too large to swallow. In some locations, including the Galapagos Islands and the Florida Keys, Great Blue Herons are known to frequent human habitations where they receive scraps of foods from the residents.

#### FLIGHT SPEED

Herons fly with a relatively slow, deep wing beat of 2.0-2.5 beats per second. Cruising birds travel at about 20-30 miles an hour. Individuals sometimes fly more than 15 miles from their nest to feed.



## TECHNICAL ARTICLES ABOUT GREAT BLUE HERONS

### General biology

Bayer, R. D. 1984. Vocalizations of Great Blue Herons at Yaquina Estuary, Oregon. Colonial Waterbirds 7:35-44. (Hard copy provided.)

Bayer, R. D. 1984. Foraging ground displays of Great Blue Herons at Yaquina Estuary, Oregon. Colonial Waterbirds 7:45-54. (Hard copy provided.)

Bent, A. C. 1926. Great Blue Heron. Pp. 101-131 in Life histories of North American marsh birds. U. S. Natl. Mus. Bull. 135. (Hard copy provided.)

General life history information.

Forbes, L. S., and E. McMackin. 1984. Extreme aggression in Great Blue Herons. Wilson Bulletin 96:318-319.

Interactions at feeding sites described.

Forbes, L. S. 1987. Predation on adult Great Blue Herons: is it important? Colonial Waterbirds 10:120-122. (Hard copy provided.)

Reports three attacks by Bald Eagles on Great Blue Herons.

Henny, C. J., and M. R. Betters. 1971. Population ecology of the Great Blue Heron with special reference to western Oregon. Can. Field Nat. 85:205-209.

Kelsall, J. P., and K. Simpson. 1980. A three-year study of the Great Blue Heron in southwestern British Columbia. Proc. 1979 Colonial Waterbird Group Meeting 3:69-74. (Hard copy provided.)

Data on 12 colonies included.

Longley, W. H. 1960. Comments on the flight distance of the Great Blue Heron. Wilson Bull. 72:289.

McCrimmon, D. A. Jr. 1982. Populations of the Great Blue Heron (Ardea herodias) in New York State from 1964 to 1981. Colonial Waterbirds 5:87-94. (Hard copy provided.)

Indicates that the breeding population in the state has grown.



Miller, R. F. 1943. The Great Blue Heron. The breeding birds of the Philadelphia region (Part II). *Cassinia* 33:1-23.

Palmer, R. S. ed. 1962. Great Blue Heron. Pp. 391-403 in *Handbook of North American birds*, Vol 1. Yale Univ. Press, New London, Connecticut. (Hard copy provided.)

Current life history information and taxonomic status.

Stephens, H. A. 1980. The Great Blue Heron in Kansas. *Trans. Kansas Acad. Sci.* 83:161-186.

Thompson, D. H. 1979. Declines in populations of Great Blue Herons and Great Egrets in midwestern states. *Proc. 1978 Colonial Waterbird Group Meeting* 2:114-127. (Hard copy provided.)

Declines linked to habitat loss.

#### Breeding biology

Blus, L. J., C. J. Henny, and T. E. Kaiser. 1980. Population ecology of breeding Great Blue Herons in the Columbia Basin, Oregon and Washington. *Murrelet* 61:63-71.

Dusi, J. L., and R. D. Dusi. 1987. A thirty-four-year summary of heron colony sites in the coastal plain of Alabama, USA. *Colonial Waterbirds* 10:27-37.

Flooding, predators, and habitat changes resulted in colony site abandonments.

Gibbs, J. P., S. Woodward, M. L. Hunter, and A. E. Hutchinson. 1987. Determinants of Great Blue Heron colony distribution in coastal Maine. *Auk* 104:38-47. (Hard copy provided..)

The degree of forestation and the distance of an island from towns were important factors in the selection of nesting sites.

Mitchell, C. A., D. H. White, and T. E. Kaiser. 1981. Reproductive success of Great Blue Herons at Nueces Bay, Corpus Christi. *Bulletin of the Texas Ornithological Society* 14:18-21.

Mock, D. W. 1976. Pair formation display of the Great Blue Heron. *Wilson Bull.* 88:185-230.

Mock, D. W. 1980. Communication strategies of Great Blue Herons and Great Egrets. *Behaviour* 72:156-170.



Pratt, H. M. 1970. Breeding biology of Great Blue Herons and Common Egrets in central California. Condor 72:407-416.  
(Hard copy provided.)

Pratt, H. M., and D. W. Winkler. 1985. Clutch size, timing of laying, and reproductive success in a colony of Great Blue Herons and Great Egrets. Auk:49-63. (Hard copy provided.)

Weise, J. H. 1978. Heron nest-site selection and its ecological effects. Pp. 27-34 in Wading birds (A. Sprunt, IV, J. C. Ogden, and S. Winckler, eds.). Natl. Audubon Soc. Res Rept. 7.

#### Feeding behavior

DesGranges, J.-L. 1979. Adaptive value of social behavior in the Great Blue Heron (*Ardea herodias*). Proc. 1978 Colonial Waterbird Group Meeting 2:192-210. (Hard copy provided.)

Suggests that colonial nesting is linked to food finding.

Dowd, E. M., and L. D. Flake. 1985. Arrival and departure patterns of Great Blue Herons at a South Dakota colony. Wilson Bulletin 97:374-378. (Hard copy provided.)

Dowd, E. M., and L. D. Flake. 1985. Foraging habitats and movements of nesting Great Blue Herons in a prairie river ecosystem, South Dakota. Journal of Field Ornithology 56:379-387. (Hard copy provided.)

Describes feeding site use of radiotagged individuals.

Hom, C. W. 1983. Foraging ecology of herons in a southern San Francisco Bay salt marsh. Colonial Waterbirds 6:37-44. (Hard copy provided.)

Information on feeding behavior and diets of Snowy Egrets, Great Egrets, and Great Blue Herons.

Krebs, J. R. 1974. Colonial nesting and social feeding as strategies for exploiting food resources in the Great Blue Heron. Behaviour 51:99-134.

Good source of information on why Great Blue Herons nest colonially.

Morey, S. R., and A. Smits. 1987. Aerial plunge foraging by a Great Blue Heron. Wilson Bulletin 99:292-293. (Hard copy provided.)



Parris, R. W. , and G. A. Grau. 1979. Feeding sites of Great Blue Herons in southwestern Lake Erie. Proc. 1978 Colonial Waterbird Group Meeting 2:110-113. (Hard copy provided.)

Two colonies traveled different distances to obtain food.

Piefer, R. W. 1979. Great Blue Herons foraging for small mammals. Wilson Bull. 91:630-631.

Powell, G. V. N. 1983. Food availability and reproduction by Great White Herons, *Ardea herodias*: a food addition study. Colonial Waterbirds 6:139-147. (Hard copy provided.)

Food availability shown to influence breeding success.

Rodgers, J. A. Jr. 1983. Foraging behavior of seven species of herons in Tampa Bay, Florida. Colonial Waterbirds 6:11-23. (Hard copy provided.)

Information on feeding behavior, efficiency, habitat use, and weather influences.

Simpson, K., J. N. M. Smith, and J. P. Kelsall. 1987. Correlates and consequences of coloniality in Great Blue Herons. Canadian Journal of Zoology 65:572-577.

Examines why Great Blue Herons nest colonially.

Thompson, D. H. 1979. Feeding areas of Great Blue Herons and Great Egrets nesting within the floodplain of the upper Mississippi River. Proc. 1978 Colonial Waterbird Group Meeting 2:202-213. (Hard copy provided.)

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Heavy metals in heron samples were generally low.

Buckley, P. A., and F. G. Buckley. 1976. Guidelines for the protection and management of colonially nesting waterbirds. USDI National Park Service, North Atlantic Regional Office, Boston, MA.



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Describes methods of tracking Great Blue Heron populations.

Faber, R. A., R. W. Risebrough, and H. M. Pratt. 1972. Organochlorines and mercury in Common Egrets and Great Blue Herons. Environmental Pollution 3:111-122.

Fleming, W. J., B. P. Pullin, and D. M. Swineford. 1984. Population trends and environmental contaminants in herons in the Tennessee Valley, 1980-81. Colonial Waterbirds 7:63-72. (Hard copy provided.)

Laporte, P. 1982. Organochlorine residues and eggshell measurements of Great Blue Heron eggs from Quebec. Colonial Waterbirds 5:95-103. (Hard copy provided.)

DDE and PCBs were found in the eggs.

Mueller, A. J., and P. O. Glass. 1988. Disturbance tolerance in a Texas wading bird colony. Colonial Waterbirds 11:119-122. (Hard copy provided.)

Description of what became of a mixed species colony of wading birds following disturbance from drilling for oil. Great Blue Herons deserted the site.

Ohlendorf, H. M., and D. M. Swineford. 1980. Organochlorine poisoning of heron. Proc. 1979 Colonial Waterbird Group Meeting 3:176-185. (Hard copy provided.)

PCBs, DDE, and Dieldrin contamination found in Great Blue Heron carcasses.

Rodgers, J. A. Jr., and J. Burger. 1981. Concluding remarks: symposium on human disturbance and colonial waterbirds. Colonial Waterbird 4:69-70. (Hard copy provided.)

Summarizes 11-paper symposium on disturbance effects at colony sites.

Vos, D. K., D. A. Ryder, and W. D. Graul. 1985. Response of breeding Great Blue Herons to human disturbance in north-central Colorado. Colonial Waterbirds 8:13-22. (Hard copy provided.)

Human intrusions disturbed birds most dramatically early in the season. Recommendations to reduce the effects of human



intrusions are discussed.

Werschkul, D. F., E. McMahon, and M. Leitschuh. 1976. Some effects of human activities on the Great Blue Heron in Oregon. Wilson Bull. 88:660-662. (Hard copy provided.)



NON-TECHNICAL MAGAZINE ARTICLES ON GREAT BLUE HERONS AND OTHER  
WADING BIRDS

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Myerriecks, A. J. 1962. Diversity typifies heron feeding. Natural History Magazine 71(jun):48.

Somanader, S. V. O. 1959. Indian pond heron. Natural Magazine 52(Dec):522.

Anonymous. 1975. Heralds of spring: the herons. National Wildlife Magazine 13(Apr):12.

Shaller, G. B. 1967. Heronry in the house. Audubon Magazine 69(May):58.

Welles, E. B. 1978. The great blue heron of Najemoy Creek Washingtonian Magazine 13(Sep):149.

Laycock, G. 1981. Animals that use tools. National Geographic World Magazine Dec:19.

Curtis, H., and Soliday, D. S. 1980. A rush of wings (breeding ritual of the egret). Geo Magazine 2(Nov):46.

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Richards, E. 1979. White wader; snowy egret of the salt marsh. Oceans Magazine 12(Nov-Dec):14.

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Hill, R. 1981. The great blue heron. Cruising World Magazine 7(Sep):78.

Toops, Connie. 1981. Final focus (snowy egret). Sierra Club Bulletin 66(Jul-Aug):78.

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Wilder, R. 1984. Murder in the nest (wading bird siblicide) Science Digest 92(May):104.

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Anonymous. 1985. The heron are nesting near Denver...see them close-up. Sunset 174(May):8.

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Kennedy, D., and McNicholl, M. K. 1986. The big bird that beats the odds (great blue heron fishing behavior). Nature Canada Magazine 15(Summer):23.

Lipsky, L. 1986. South Florida's water birds. Oceans Magazine 19(May-Jun):34.

Rice, J. 1986. A matter of gravity (Louisiana's herons). Natural History Magazine 95(Jan):50.

Powell, G. V. N., A. H. Powell, and N. K. Paul. 1988.

Brother, can you spare a fish? Florida's panhandling great white herons may be trying to tell us something about the environment. Natural History Magazine 97(Feb):34.

Higuchi, H. 1987. Cast master (green-backed heron fishing behavior). Natural History Magazine 96(Aug):40.

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## TECHNICAL ARTICLES ABOUT OSPREYS

### General biology

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Basic overview of natural history.

Palmer, R. S. ed. 1988. Osprey. Pp. 73-101 in Handbook of North American birds, Vol. 4. Yale Univ. Press, New Haven, Connecticut. (Hard copy provided.)

Up-to-date overview of general biology.

Prevost, Y. A. 1983. Osprey distribution and subspecies taxonomy. Pp. 157-174 in Biology and management of Bald Eagles and Ospreys. Harpell Press, Ste. Anne de Bellevue, Quebec, Canada. (Hard copy provided.)

Taxonomically, Ospreys can be divided into four subspecies.

Henny, C. J. 1983. Distribution and abundance of nesting Ospreys in the United States. Pp. 175-186 in Biology and management of Bald Eagles and Ospreys. Harpell Press, Ste. Anne de Bellevue, Quebec, Canada. (Hard copy provided.)

Approximately 8,000 Osprey nested in the contiguous U. S. in the early 1980s.

Macnamara, M. 1972. Sexing the American Osprey using secondary sexual characteristics. Pp. 43-45 in Transactions of the North American Osprey research conference (J. C. Ogden, ed.). Natl. Park Serv., Washington, D. C. (Hard copy provided.)

Size and breast plumage can be used to sex Osprey.

Santana C., E., and S. A. Temple. 1987. Recoveries of banded Ospreys in the West Indies. J. Field Ornithol. 58:26-30. (Hard copy provided.)

Most West Indian Ospreys were banded in the eastern US.

### Breeding biology

Green, R. 1976. Breeding behaviour of Ospreys in Scotland. Ibis 118:475-490.



Grover, K. E. 1984 Nesting distribution and reproductive status of Ospreys along the upper Missouri River, Montana. *Wilson Bull.* 96:496-498. (Hard copy provided.)

Hagan, J. M. 1986. Temporal patterns in pre-fledgling survival and brood reduction in an Osprey colony. *Condor* 88:200-205. (Hard copy provided.)

Sibling aggression was common in this NC colony. Parents did not interfere with sibs as they fought, and they fed whichever sib begged most vigorously.

Henny, C. J., and A. P. Noltemeier. 1975. Osprey nesting populations in the coastal Carolinas. *Am. Birds* 29:1073-1079. (Hard copy provided.)

Provides basic information on mid-1970 population levels, nest sites, etc.

Jamieson, I., N. Seymour, R. C. Bancroft, and R. Sullivan. 1983. Sibling aggression in nestling Ospreys in Nova Scotia. *Can. J. Zool.* 61:466-469.

Kushlan, J. A., and O. L. Bass, Jr. 1983. Decreases in the southern Florida Osprey population, a possible result of food stress. Pp. 187-200 in *Biology and management of Bald Eagles and Ospreys*. Harpell Press, Ste. Anne de Bellevue, Quebec, Canada. (Hard copy provided.)

Low food availability in Florida Bay may have been the cause of a 58% reduction in Osprey numbers during an 8-year period.

Levenson, H. 1979. Time and activity budgets of Ospreys nesting in northern California. *Condor* 81:364-369.

Poole, A. 1979. Sibling aggression among nestling Ospreys in Florida Bay. *Auk* 96:415-417. (Hard copy provided.)

Describes sibling aggression in a food-stressed population.

Poole, A. F. 1983. Courtship feeding, clutch size, and egg size in Ospreys: a preliminary report. Pp. 243-256 in *Biology and management of Bald Eagles and Ospreys*. Harpell Press, Ste. Anne de Bellevue, Quebec, Canada. (Hard copy provided.)

Documents remarkable stability in clutch size from year to year.



Poole, A. 1985. Courtship feeding and Osprey reproduction. *Auk* 102:479-492. (Hard copy provided.)

Suggests that courtship feeding serves to enhance mate fidelity rather than to enhance female nutritional status.

Stinson, C. H., and M. A. Byrd. 1976. A comparison of past and present Osprey breeding populations in coastal Virginia. *Bird Banding* 47:258-262. (Hard copy provided.)

Compares historic and present population levels in coastal Virginia.

Van Daele, L. J., and H. A. Van Daele. 1982. Factors affecting the productivity of Ospreys nesting in westcentral Idaho. *Condor* 84:292-299. (Hard copy provided.)

Productivity of a breeding population at a reservoir was linked to water level, and, thus, to prey availability.

#### Feeding behavior

Grubb, T. C., Jr. 1977. Weather-dependent foraging in Ospreys. *Auk* 94:146-149. (Hard copy provided.)

Windy and cloudy weather reduce hunting success.

Grubb, T. C., Jr. 1977. Why Ospreys hover. *Wilson Bull.* 89: 149-150. (Hard copy provided.)

Dives from hovers are 50% more successful.

Jamieson, I., N. Seymour, and R. P. Bancroft. 1982. Use of two habitats related to changes in prey availability in a population of Ospreys in northeastern Nova Scotia. *Wilson Bull.* 94:557-564. (Hard copy provided.)

More dependent fish resources in coastal areas mean that coastal Osprey do not need to forage as far afield to secure prey for their young.

Layher, W. G. 1984. Osprey preys on Canada Goose gosling. *Wilson Bull.* 96:469-470. (Hard copy provided.)

Schaadt, C. P., and L. M. Rymon. 1982. Innate fishing behavior of Ospreys. *Raptor res.* 16:61-62. (Hard copy provided.)

Documents prey captures by recently fledged Ospreys.



Conservation

Henny, C. J., et al. 1977. Mid-Atlantic coast osprey population: present numbers, productivity, pollutant contamination, and status. *J. Wildl. Manage.* 41:254-265. (Hard copy provided.)

Documents population trends in the early 1970s as a function of pesticide contamination.

Schaadt, C. P., and L. M. Rymon. 1983. The restoration of Ospreys by hacking. Pp. 299-306 in *Biology and management of Bald Eagles and Ospreys*. Harpell Press, Ste. Anne de Bellevue, Quebec, Canada. (Hard copy provided.)

Documents successful use a falconry technique in increasing Osprey populations in Pennsylvania.

Spitzer, P. R., A. F. Poole, and M. Scheibel. 1983. Initial population recovery of breeding Ospreys in the region between New York City and Boston. Pp. 231-242 in *Biology and management of Bald Eagles and Ospreys*. Harpell Press, Ste. Anne de Bellevue, Quebec, Canada. (Hard copy provided.)

Documents recovery of population following the ban on DDT use in the Northeast.

Spitzer, P. R., R. W. Risebrough, J. W. Grier, and C. R. Sindelar, Jr. 1972. Eggshell thickness-pollutant relationships among North American Ospreys. Pp. 13-20 in *Transactions of the North American Osprey research conference* (J. C. Ogden, ed.). Natl. Park Serv., Washington, D. C. (Hard copy available.)

Eggs with thinner shells were more heavily contaminated.

Westall, M. A. 1983. An Osprey population aided by nest structures on Sanibel Island, Florida. Pp. 287-292 in *Biology and management of Bald Eagles and Ospreys*. Harpell Press, Ste. Anne de Bellevue, Quebec, Canada. (Hard copy provided.)

Artificial nest sites produced more young than did natural nest sites.



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- Peterson, R. T. 1964. Senators hear Peterson on osprey decline; summary of address, April 22, 1964. Audubon Magazine 66(Sep):276.
- Guilliard, E. T. 1962. Resilient predators. Natural History Magazine 71(Dec):42.
- Anonymous. 1959. Return of the osprey. Science News Letter 75(Mar):160.
- Puleston, D. 1975. Return of the osprey. Natural History Magazine 84(Feb):52.
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- Singletary, C. 1973. Private life of the osprey. Audubon Magazine 75(Nov):60.
- Frye, J. 1973. Can the osprey survive? Yachting Magazine 133(May):90.
- Peterson, R. T. 1969. Osprey; endangered world citizen. Reader's Digest Magazine 95(Nov):86.
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- Backstrom, B. G. 1979. How to catch a fish in three seconds. Natural History Magazine 88(Feb):72.
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- Beverley, R. 1975. Osprey and eagle. Conservationist Magazine 30(Dec):8.
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- Bell, T. G. 1980. The osprey of Boca Grande. Sea Frontiers Magazine 26(Jan-Feb):31.
- Forness, M., and T. Jurczak. 1981. Operation osprey. Conservationist Magazine 36(Jul):40.
- Lee E. 1983. Osprey: the fishing hawk. Sports Afield Magazine 190(Aug):58.
- Chubb, K. 1986. An oar for an osprey. Nature Canada Magazine 15(Fall):44.
- Howard, J. 1985. Bringing back the Osprey. Yankee Magazine 49(May):16.
- Kopper, P., and C. Singletary. 1988. Grand old ospreys: once declining, these fish hawks are back. Oceans Magazine 21(Feb):50.
- Horgan, J. 1987. Flocking together: it may help ospreys fish more efficiently. Scientific American Magazine 257(Dec):40.
- Green, E. 1988. Birds of a feather flock together: for ospreys the benefits may be gastronomical. Nature Canada Magazine 17(Winter):7.



SOURCES OF SLIDES FOR ILLUSTRATING INTERPRETIVE TALKS ABOUT  
OSPREYS AND GREAT BLUE HERONS

Sources of slides for both species

(I recommend three potential sources of slides for both species. I have purchased slides from the first two without any problems. The third source has been recommended to me by several colleagues.)

1. VIREO (Visual Resources in Ornithology), The Philadelphia Academy of Natural Sciences, 19th Street and The Parkway, Philadelphia, PA 19103. (Although they do have a rather detailed, but difficult to use catalog of their slides, I have found that the best way to deal with VIREO is to write them asking for a description of the types of slides that they currently have illustrating the species desired. Typically they have at least a half dozen slides of each species, including illustrations of nestlings, birds in the nest, in flight, feeding etc. Overall, VIREO has the highest quality slides of any vendor I know. Most slides are priced at \$2.00-\$2.50. I recommend ordering as many images of each species that they have.)

2. Cornell Laboratory of Ornithology, 159 Sapsucker Road, Ithaca, NY 14850. (The Lab of Ornithology usually has several slides of each North American species. Although overall quality tends to be lower than slides from VIREO, the slides from Cornell are also rather inexpensive [\$2.00-2.50], and I recommend purchasing whatever they have. Both Cornell and VIREO offer slides in taxonomic sets [i.e., wading birds and raptors]. You may want to order them as well.)

3. Sea and Sage Audubon of Santa Ana, 822 E. Park lane, Santa Ana, CA 92701. (I have not purchased slides from this organization. I recommend requesting their catalog.)

Additional sources of slides of Ospreys

1. Dr. Alan Poole, Manomet Bird Observatory, Box 936, Manomet, MA 02345. (Dr. Poole has just completed a book on Osprey behavior and ecology based on his studies of Ospreys in New England. He is a close friend of mine. He has been doing considerable color banding of Ospreys. I recommend you write him, using my name, and ask him to consider selling you slides for use in interpretive talks.)



2. Mr. Mark Westall, 2058 Wild lime Drive, Sanibel FL 33957.  
(Mr. Westall is Director of the International Osprey Foundation.  
He too is a close friend of mine. He has been involved in  
monitoring Osprey populations in Florida, and he has considerable  
experience with Ospreys nesting on artificial structures. I  
recommend you write him, using my name, and ask him to consider  
selling you slides for use in interpretive talks.)

Additional sources of slides of Great Blue Herons

1. Dr. George Powell, National Audubon Society Research  
Department, 115 Indian Mound Trail, Tavernier, FL 33070. (Dr.  
Powell has been studying Great Blue and Great White herons in the  
Florida Keys for a number of years. He has a number of beautiful  
slides of both subspecies. He too is a close friend. I  
recommend you write him, using my name, and ask him to consider  
selling you slides for use in interpretive talks.)

Sources of videos for both species

Although I am not certain of the extent of their holdings, I  
recommend contacting the producers of Naturescene at SCETV in  
Columbia for video footage of Great Blue Herons and Ospreys.

I know of no videos on Great Blue Herons per se, but Dr. Alan  
Poole (mentioned above) did assist in the production of a video  
on Ospreys in the early 1980s. The video, which has appeared on  
PBS, runs about 55 minutes, and is called "Return of the Osprey."  
I recommend asking Dr. Poole about its availability when you  
write him concerning his slide collection.





